A. FAYWISCHEWITSCH.

STEAM TURBINE.

APPLICATION FILED OCT. 11, 1907.

911,653.

Patented Feb. 9, 1909.

2 SHEETS—SHEET 1.

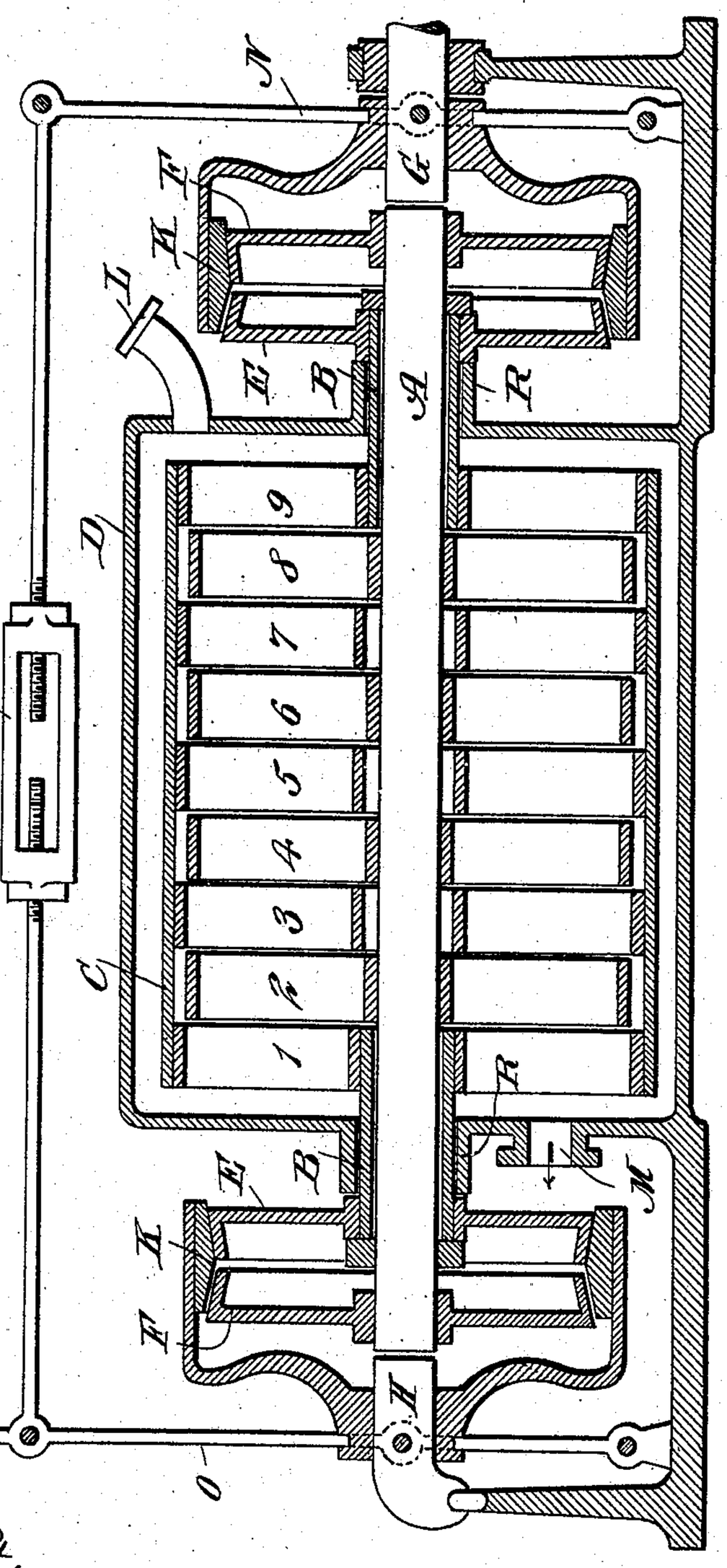

Fig. 1.

WITNESSES

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2 SHEETS—SHEET 2.

Fig. 2.

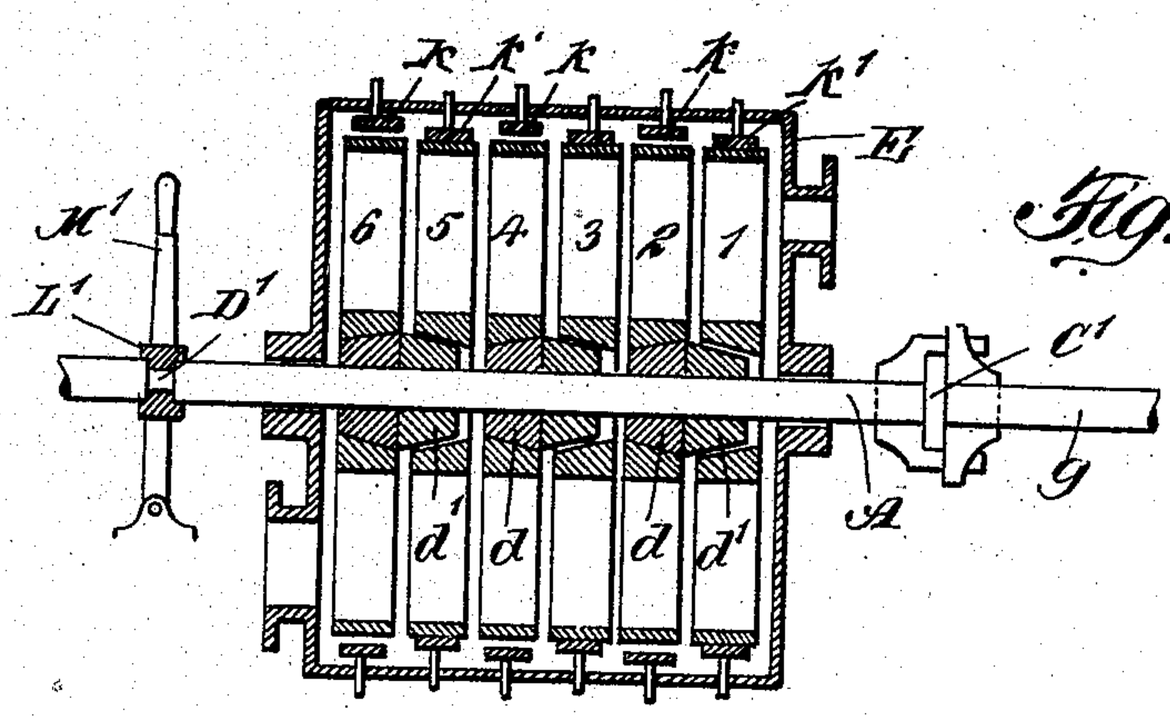


Fig. 3.

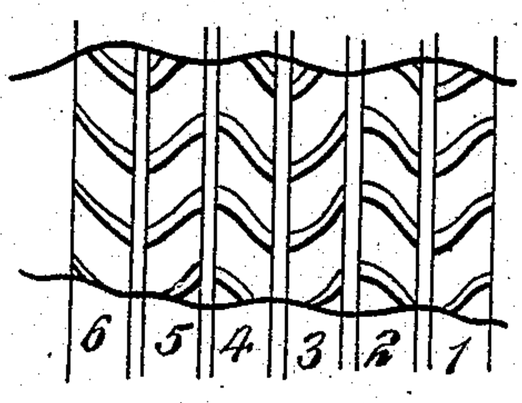


Fig. 4.

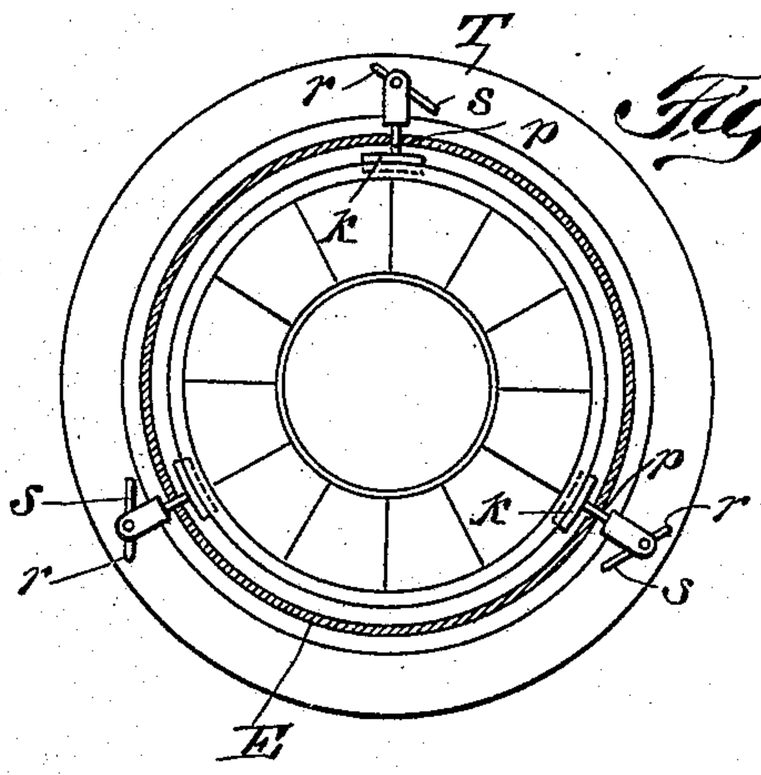


Fig. 5.

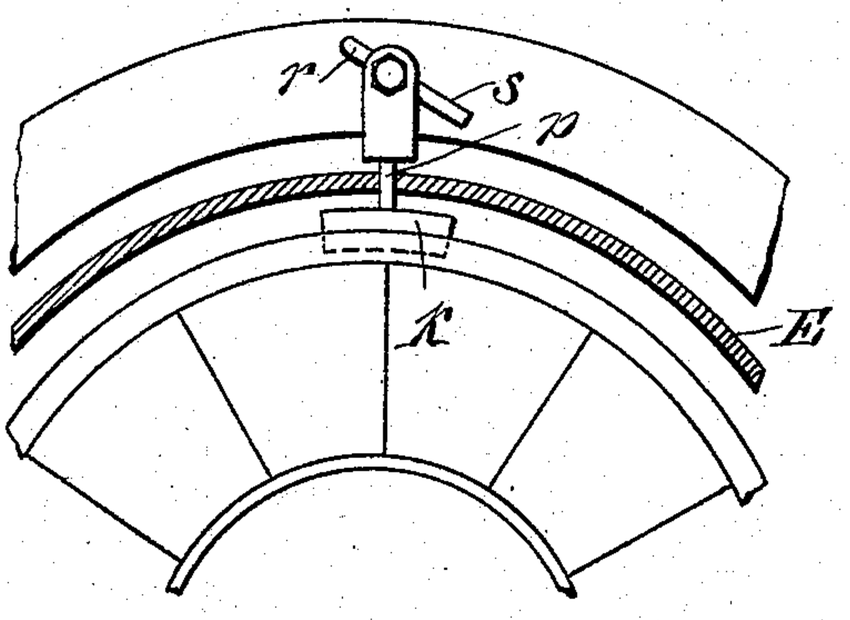
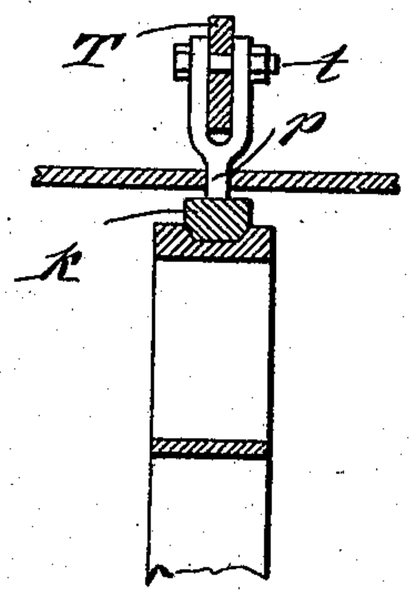


Fig. 6.



WITNESSES

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UNITED STATES PATENT OFFICE.

ALEXANDER FAYWISCHEWITSCH, OF MITTWEIDA, GERMANY.

STEAM-TURBINE.

No. 911,653. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed October 11, 1907. Serial No. 396,963.

To all whom it may concern:

Be it known that I, ALEXANDER FAYWISCHEWITSCH, of Mittweida, Germany, engineer, have invented new and useful Improvements in Steam-Turbines, of which the following is a full, clear, and exact description, reference being made to the accompanying drawings, and to the letters of reference marked thereon.

Every turbine-engine consists, as is well known, of a series of disks or blades, set in turbine wheels fixed rigidly on the turbine shaft, and of another series of disks or blades fastened to the exterior stationary casing or shell of the turbine between the former disks and serve to change the current of steam or gas in the proper manner. Such an arrangement of turbine-engines admits movement only in one direction.

The present invention affords the possibility of changing the construction of all the existing turbine-engines in such a manner as to communicate movement to them in both directions.

The invention is based on the utilization of the tendency of the directing blades of the existing turbines to rotate in the direction opposite to the rotation of the driving or working blades and in the turbine, constructed according to the proposed invention, the directing blades play the part of driving blades during the return movement.

On the annexed drawings are represented diagrammatically, as an example, two arrangements of the proposed steam turbine of any system, Figure 1 representing a vertical section of the turbine of the first type; Fig. 2 is a similar view of a turbine of the second type; Fig. 3 is a diagrammatical arrangement of the blades of the turbine; Figs. 4, 5 and 6 are details of the construction.

The turbine of the first type (Fig. 1) is furnished with an odd-number of turbine wheels, nine for instance, (1, 2, 3, 4, 5, 6, 7, 8 and 9). The extreme wheels 1 and 9 are fastened to sleeves B B, serving as bearings for the turbine shaft A, on which the even-numbered wheels 2, 4, 6 and 8 are fastened. All the odd-numbered wheels 1, 3, 5, 7 and 9 are fastened to the shell C. This shell C is inclosed in the exterior stationary casing D, furnished with openings L for the admission of steam and the exhaust opening M and also furnished with bearings R and R′ in which sleeves B B can rotate.

The direction of the steam, the regulation and utilization of the expansion is performed in a similar manner as in the existing turbines. The extremities of the sleeves B and B (connected to the odd wheels) project from both ends of the exterior shell and the extremities of the shaft A (connected with the even-numbered disks) project from the former extremities.

If the sleeves B and B are retained against movement and steam is admitted to the turbine, the even-numbered wheels will rotate with the shaft A. If on the contrary sleeves B and B are released and the shaft A is stopped, the odd-numbered wheels will rotate with the sleeves B and B, but in the reverse direction. The detention or stoppage of the shaft A or sleeves B B may be performed with the aid of sockets E, F, and E′, F′ for instance, one half of each socket E, E′ being set on the sleeves B, B and the other half F, F′—on shaft A.

If with the aid of the handle Q and the levers N, O, P the blocks K, K′ are moved in such a manner that the sockets E and F should couple up the shaft A with the shaft G, connected with the propelling screw, for instance, (not shown in the drawing), the latter will rotate in one direction. In the case of a reverse movement of the levers N, O, P, the shaft A will remain motionless and sleeves B, B will be coupled with the shaft G, in view of which fact the latter will rotate in the opposite direction.

Practice has shown that the above mentioned construction of turbine is suitable only for small engines, as the sockets F encounter very powerful shocks in reversing the movement of large engines.

A turbine is hereinafter described, which is intended for large engines and is characterized by the following peculiarities, as compared with the construction heretofore described:

1. The stopping and connection of the turbine wheels with the turbine shaft take place for each turbine wheel separately.

2. The hollow shaft (odd-numbered turbine wheel shaft) is omitted in this case and in view of this, the complicated bearing also.

The turbine of this type has only one shaft A (Fig. 2) which is connected with the working shaft *g* by a special coupling C^1. The number of turbine wheels is not limited and even, the odd turbine wheels being in-

tended for the forward movement and the even ones for the backward movement. The working shaft *g* receives forward or backward movement, depending upon the turbine wheels with which the turbine shaft A is connected (with odd or even-numbered turbine wheels).

In Fig. 2 the even - numbered turbine wheels are shown connected with the turbine shaft A, and when the steam enters the shaft *g* receives backward movement (opposite to the hands of a clock). On freeing the even-numbered turbine wheels and connecting them with shaft A and on stopping the odd-numbered turbine wheels at the same time, the shaft *g* receives forward movement (in the direction of the movement of the hands of a clock).

The connection of one kind of turbine wheels with the shaft A and the simultaneous disconnection of other turbine wheels from this shaft is performed by moving the shaft A along its axis and the alternating stopping of the turbine wheels is performed by means of special blocks *k* (for the even-numbered turbine wheels) and k_1 (for the odd - numbered turbine wheels). Taper wheels *d* (with a screw thread) are set rigidly on the shaft A for the even-numbered turbine wheels and wheels d_1 (also with a screw thread) for the odd - numbered turbine wheels.

In Fig. 2 the wheels *d* are coupled with the even-numbered turbine wheels and the odd-numbered turbine wheels are free (stopped with blocks k_1).

If the even-numbered turbine wheels are stopped during the movement with blocks *k*, the shaft A will continue to rotate by inertia and will become disconnected from the even-numbered turbine wheels. The thread is made so as not to allow the turbine wheels to move along the axis. Besides the thread, the odd-numbered turbine wheels are held by the pressure of the steam on the blades, owing to the taper surface of the wheels d_1 and the interior openings of the odd-numbered turbine wheel naves.

The shaft A becomes disconnected from one kind of turbine wheels owing to inertia; but in order to connect it with the other kind of turbine wheels it is necessary to give it progressive movement from the outside, this being attained with the aid of a special lever M_1 and a ring L_1 in the neck D_1.

There is a pressure ring T outside the shell opposite each turbine wheel for the even-numbered turbine wheels and another ring for the odd-numbered ones (not shown in the drawings) with slots *r s*, according to the number of blocks. The difference between the two rings consists only in the fact that the slots *r s* are made in reverse directions, so that during the rotation of the pressure ring in the direction of the hands of a clock, the rings T will press upon the slots and the other rings will release them. It is advantageous to make not less than three blocks on each pressure ring. The block *k* consists of a cushion and a stem *p*, which is forked at one end (Fig. 6). A bolt *t* passes through the double or fork-shaped part *p*, which moves along the slot *r s* during the rotation of the pressure ring. There is a groove on the exterior of each turbine wheel into which the cushion *k* enters on the downward pressure of the same. The stopping and release of the turbine wheels takes place owing to the rotation of the pressure rings in either direction. All the pressure rings are connected together in such a manner as to afford the possibility of pressing or lowering all the even-numbered turbine wheels simultaneously and to lower or press all the odd-numbered turbine wheels simultaneously. The socket C_1 between the shafts A and *g* is arranged in such a manner as to make it possible for the shaft A to have certain progressive movement along the axis without breaking its connection with the shaft *g*.

What I claim as new is:

1. In a steam turbine of the character described, the combination with a turbine shaft, of means for moving the same axially, a series of turbine wheels and means carried by said turbine shaft for engaging alternate turbine wheels whereby certain of said blades may revolve and the remainder of said wheels remain stationary, substantially as described.

2. In a steam turbine of the class described, the combination with a turbine shaft, of a series of blocks carried by said shaft, adjacent blocks having their surfaces inclined in opposite directions, means for moving the same axially and a plurality of turbine wheels having bearings inclined correspondingly to the inclination of the blocks whereby when said shaft is moved axially certain of the turbine wheels are caused to engage with the blocks and are given rotary motion, and other of the wheels are released from the blocks and remain stationary, substantially as described.

3. In a steam turbine of the class described, the combination with a turbine shaft, of means for moving the same axially, a plurality of blocks carried by said shaft, adjacent blocks having their surfaces inclined in opposite directions and threaded, a plurality of turbine wheels having threaded bearings inclined in accordance with the inclination of the blocks, and means for causing certain of said turbine wheels to be engaged by the blocks and to revolve with the shaft, and other of said turbine wheels to be released from the blocks and remain stationary, substantially as described.

4. In a steam turbine of the class described, the combination with a turbine shaft, of a plurality of turbine wheels, means

for moving the shaft axially, means carried by the shaft whereby certain predetermined turbine wheels may be coupled to the shaft, and means exterior to the turbine wheels for holding certain other of said turbine wheels stationary, substantially as described.

5. In a steam turbine of the class described, the combination with a turbine shaft, of a plurality of blocks carried thereby, a plurality of turbine wheels adapted to be engaged by said blocks and caused to revolve with the shaft, means for moving the shaft axially to release certain of said wheels and engage others thereof, and pressure rings adapted to bear upon said turbine wheels, substantially as described.

6. In a steam turbine of the class described, the combination with a stationary casing provided with steam inlet and exhaust openings, of a turbine shaft journaled in said casing, a plurality of blocks carried by said shaft, a plurality of turbine wheels adapted to engage the blocks and rotate with the shaft, cushion blocks adapted to contact with the peripheries of said turbine wheels, and pressure rings arranged in series and adapted to press the cushion blocks against the turbine wheels, substantially as described.

7. In a steam turbine of the class described, the combination with a casing, of a shaft mounted therein, a plurality of blocks carried by said shaft, each of said blocks presenting the appearance of two truncated cones base to base, and a plurality of turbine wheels each of which has its nave formed to engage one of the said cones, substantially as described.

8. In a steam turbine of the class described, the combination with a casing of a shaft mounted therein, a plurality of blocks carried by said shaft, each said block presenting the appearance of two truncated cones base to base, a plurality of turbine wheels, the naves of adjacent blades being inclined in opposite directions, and means for moving the shaft axially to cause predetermined blocks to engage predetermined turbine wheels, substantially as described.

9. In a steam turbine of the class described, the combination with a casing, of a shaft mounted therein, a plurality of blocks carried by said shaft each said block presenting the appearance of two truncated cones base to base, a plurality of turbine wheels having naves inclined to correspond with the shape of the block surfaces, means for moving the shaft axially to cause the engagement of certain turbine wheels with certain blocks, and means for securing against movement those turbine wheels not in engagement with the blocks, substantially as described.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

ALEXANDER FAYWISCHEWITSCH.

Witnesses:
HBT. APPLEYARD,
W. J. KONJETSNY.